# DEC STD 088-0 Qualification Procedure for All Printed-Wiring Board Suppliers

**DOCUMENT IDENTIFIER:** A-DS-EL00088-00-0000 Rev C, 04-Dec-1992

**ABSTRACT:** This standard establishes the procedures and minimum requirements to qualify, retain, requalify, or disqualify a printed-wiring board (PWB) supplier to Digital.

**APPLICABILITY:** The requirements of this standard are mandatory for Digital organizations responsible for sourcing the following revenue products: prototypes, pilot lots, PWBs directly shipped to Digital's stage 1 assembly plants, and volume. The requirements of this document apply to all internal and external PWB contractors who supply PWBs to Digital.

**STATUS:** APPROVED 04-Dec-1992; use VTX SMC for current status.

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**DEC STD 088-0 Qualification Procedure for All Printed-Wiring Board Suppliers**

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APPROVAL: This document has been reviewed and recommended for approval by the General Review group for its category.

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Use VTX SMC to order copies of this document from Standards and Methods Control. Send distribution questions to JOKUR::SMC or call DTN: 234-4423.

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# 1 PURPOSE

This standard establishes the procedures and minimum requirements to:

- Qualify, retain, or disqualify a printed-wiring board (PWB) supplier as meeting all applicable requirements of this document.
- Add qualified suppliers to the Corporate Qualified Vendor List (QVL).
- Requalify or disqualify process changes to existing products (or technologies) for previously qualified suppliers.
- Disqualify a supplier for cause.

## 1.1 GOAL

The goal of this standard is to provide PWB sourcing organizations with a consistent method that can be uniformly applied and administered on a worldwide basis for qualifying or disqualifying suppliers.

Consistent with this goal, the application of the requirements of this document will result in the following.

- Ensure proper sourcing decisions to meet Digital's overall product needs in order to promote long-term relationships with qualified suppliers.
- Enable and support the Interconnect Center of Expertise (ICOE) quality goals for inclusion of PWBs into the Qualified Vendor List/Approved Vendor List (QVL/AVL) processes, as well as promoting the overall Digital goals for addressing quality programs throughout the supply base.

## 1.2 APPLICABILITY

The requirements of this standard are mandatory for Digital organizations responsible for acquiring the following products which will be used for revenue ships.

- Prototypes
- Pilot build
- PWBs shipped directly to Digital's Stage 1 assembly plants (such as direct buy)
- Volume

In addition, the requirements apply to all internal and external PWB contractors and subcontractors who supply PWBs to Digital. The requirements do not apply to PWBs purchased for internal use only (IUO).

## 1.3 RESPONSIBILITY

The following organizations are required to participate as partners in the decision-making process leading to the qualification and disqualification of suppliers. For definitions of these groups, refer to the Glossary.

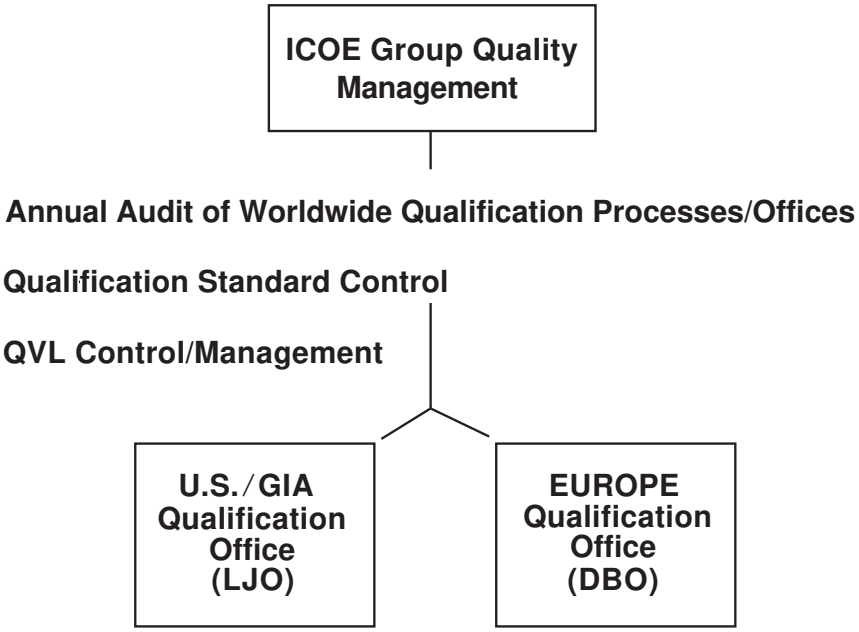
1. Design Engineering shall:
    - Oversee the actual Digital program or product containing the PWBs as a component.

- Initiate the implementation of the requirements of this document for new products at the earliest stage of the program or design cycle.
- Participate in all qualification recommendations for new or existing suppliers, materials, and processes used in new or existing products.

2. Purchasing shall:
   - Initiate the implementation of the requirements of this document when identifying and qualifying new or existing external suppliers.
3. Sourcing entities involved with purchasing PWBs and qualifying suppliers for Digital shall:
   - Form the Qualification Team or participate in a new product Qualification Team empowered by Design Engineering to qualify suppliers for new products.
   - Initiate and execute the qualification process.
   - Communicate the documentation requirements and updates to suppliers.
   - Be responsible for the understanding and compliance of this standard.
4. Qualification Team shall:
   - Interface with the supplier.
   - Prepare a Qualification Plan.
   - Participate in the qualification process of the supplier.
   - Implement the minimum requirements set forth in this standard.
5. Stage 1 assembly shall:
   - Identify and communicate detailed product-specific requirements.
   - Provide supporting documentation pertinent to the supplier qualification or disqualification process.
6. PWB suppliers shall:
   - Follow the requirements of this standard.
   - Be aware that Digital will perform random periodic assessments (with or without prior notice) of their product or process in order to retain qualification.
7. Area Qualification Office (described in Figure 1) shall:
   - Ensure consistent application of this document.
   - Maintain all documentation and files required for the implementation of this standard.
   - Serve as a consultant for application, technical service, and training for those groups responsible for implementation of this standard, in their respective geographical areas.
   - Manage the qualification retention process.
   - Be a resource for application, interpretation, and training.
   - Submit qualified supplier information to ICOE quality management for placement on the QVL.

8. Deviations to this standard must get approval by the team and by the ICOE quality manager. The area qualification office must be notified of all waiver requests.
   - ICOE quality manager ensures consistent applications of DEC STD 088-0.
   - ICOE quality manager ensures approval and disapproval deviations to DEC STD 088-0.

**Figure 1: PWB Qualification Office Schema**



## 1.4 DEC STD 088-0 COMMITTEE

The DEC STD 088-0 Committee is comprised of cross-functional representatives from Digital. The committee is responsible for the technical content and requirements of this standard. Proposed changes to this standard should be submitted, in writing, to any one of the following representatives. Refer to Table 1 for a list of representatives.

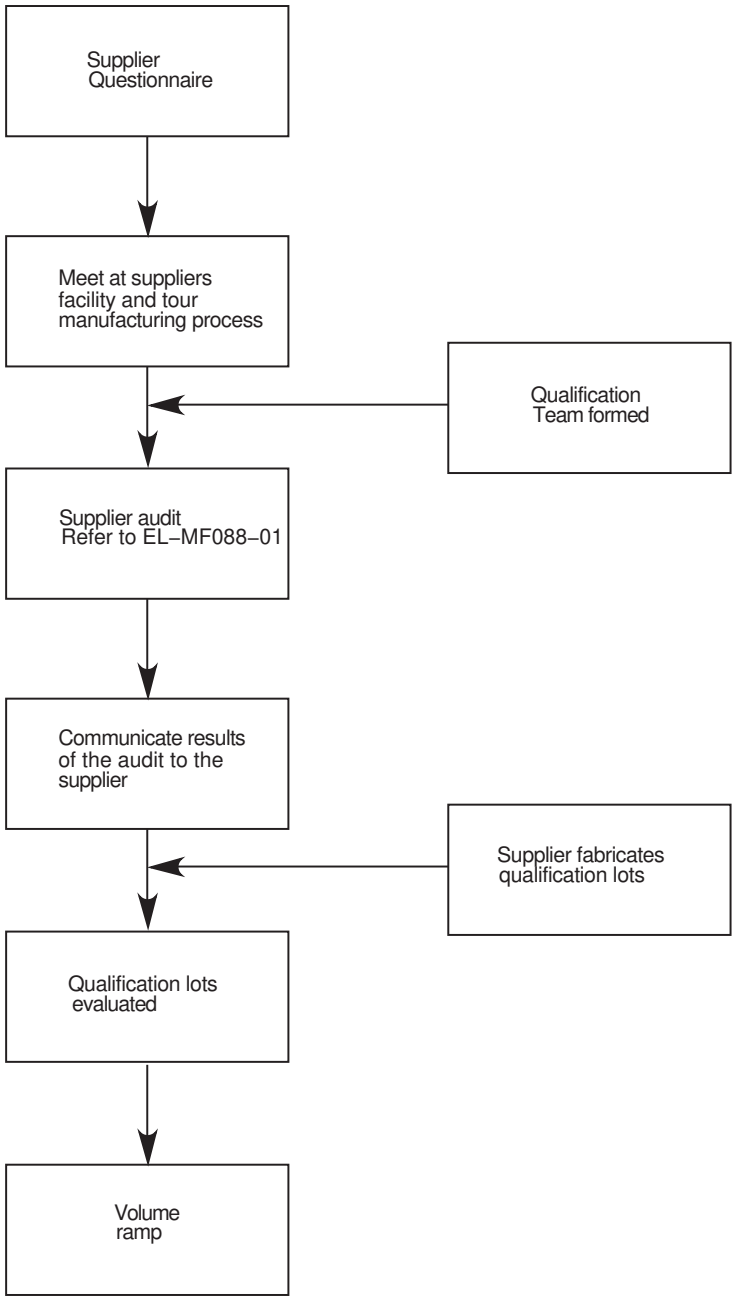
**Table 1: DEC STD 088-0 Standards Committee**

| Group Name | Name | Location |
|---|---|---|
| ICOE Quality | Dick Plutnicki | LJO1 |
| PWB Component Engineer | Gerald Gagnon | LJO1 |
| PWB Commodity Management | Joe Bruccoliere | LJO1 |
| PWB New Products | Valerie St. Cyr | LJO1 |
| NRO Material Lab | Dave Quaranta | NRO5 |
| U.S./GIA Qualification Office | Bill Cahill | LJO1 |
| European Qualification Office | Gerry Kerr | DBO |
| GIA/PWB Quality Engineer | Mark Judson-Ebbets | LJO1 |
| KAO Supplier Engineer | Steve York | KAO |
| Manufacturing Tech. TME | Pete Lison | MLO |
| ASO Manufacturing | Al Vorhis | ASO |
| SGO Manufacturing | Jose Rodriguez | SGO |
| JKL Lab | Toshiki Sasabe | JKL |

**Table 2: Alternates**

| Group Name | Name | Location |
|---|---|---|
| PWB New Products | Dick Sullivan | BXB |
| NRO Material Lab | Paul Terranova | NRO5 |
| European Qualification Office | Mike Allen | LTN |
| KAO Supplier Engineer | Bill Birch | KAO |

**Figure 2: Overview of Supplier Qualification Process Diagram**


Supplier Questionnaire
Meet at suppliers facility and tour manufacturing process
Qualification Team formed
Supplier audit Refer to EL–MF088–01
Communicate results of the audit to the supplier
Supplier fabricates qualification lots
Qualification lots evaluated
Volume ramp

# 2 SUPPLIER QUALIFICATION REQUIREMENTS

This standard provides the methods to qualify a supplier in such areas as business matrix issues, materials, processes, and product technology. PWBs can only be acquired from the suppliers that meet the requirements of this document and appear on the QVL.

Alternative qualification conditions are available to Qualification Teams for application in cases where the supplier's process control is at such a level that it can be used as evidence of stable conformance of product to specification. The Qualification Team should refer to Appendix E for guidelines.

## 2.1 ELEMENTS

To qualify a supplier of PWBs to Digital, the following elements must be addressed.

a. Business/operations analysis
   - Questionnaire—Refer to EL-MF088-00, *Printed-Wiring Board (PWB) Supplier Questionnaire*.
   - Audit—Refer to EL-MF088-01, *Printed-Wiring Board Supplier Audit Checklist*.
   - Corrective Action Procedures.

b. Process qualification
   - Certified test facility. Refer to EL-MF088-03, *Laboratory Certification and Audit Procedures for Facilities that Inspect/Test Printed-Wiring Boards (PWBs)*.
   - Stage 1 assembly evaluation.

c. Product qualification
   - Certified test facility. Refer to EL-MF088-03.
   - Stage 1 assembly evaluation.

d. First article inspection (FAI)

## 2.2 REQUIREMENTS (REFER TO APPENDIX E FOR GUIDELINES)

To qualify a supplier of PWBs to Digital, the following requirements must be followed.

1. Business/operations qualification is required for all new suppliers and for the ongoing retention of existing suppliers.
2. Process qualification is required for all new suppliers. For an existing supplier, process qualification is required when the sourcing entity or Qualification Team determines that one or more of the following exists.
   - Significant change has occurred in process compared to the previously qualified process (such as change in plating chemistries). Refer to subhead 3.2 for more information on process qualification.
   - Process qualification may also be used to qualify a unique process or material independent of product such as the use of test cases.
3. For any supplier, product qualification is not required if all of the following technology attributes exist, unless deemed otherwise by the Qualification Team.
   - Layers—less than five

- Minimum line width/space (L/S )—greater than or equal to 0.3048/0.3302 millimeters [0.012/0.013 inches]
- Aspect Ratio (A/R)—less than or equal to 3:1
- Material—FR4, CEM3
- Product does not contain other high technology attributes such as, but not limited to, controlled impedance, planar resistor, and exotic materials.

4. Product qualification is required for a given supplier when the Qualification Team determines that one of the following factors exists.
   - The part incorporates new or higher technology attributes (including layup) beyond those in item 3 of this subhead 2.2 and the supplier is not qualified for that level of technology. Refer to Appendix F to determine levels for each attribute when comparing supplier qualification status to the part number requirements.
   - The part number contains unique or interacting combinations of attributes (such as the combination of 12.5 mil pitch surface mount technolgy (SMT) and solder mask over bare copper (SMOBC)). Refer to subhead 3.3 for more information on product qualification.
5. First article inspection (FAI) is not required when a supplier has completed process and/or product qualification for a specific part number and associated part revision.
6. FAI is required when a new part number and/or revision is sourced to a supplier that is qualified to build that technology but who has never built the part number or part revision.

## 3 SUPPLIER QUALIFICATION

The following requirements shall be used to qualify a new supplier to Digital resulting in placement of that supplier on the QVL. During the overall qualification process, references to particular subheads for the qualification of processes and products of a supplier will occur. Refer to Figure 2 for an example of the supplier qualification process.

### 3.1 SUPPLIER QUALIFICATION PROCEDURES

To complete the following procedures for a new external supplier, begin at step number 1. For an existing supplier, begin at step number five. Conclusions may result in the process being terminated at certain given points, during the qualification procedure.

1. The sourcing entity (Purchasing function) shall:
   - — Administer the supplier questionnaire or equivalent. Refer to EL-MF088-00 for the supplier questionnaire.
   - — Obtain a signed Nondisclosure Agreement from the supplier before ensuing any further business.
   - — Assess and determine the supplier's minimum suitability and either:
   - Proceed to the next step.
   - End the process.

2. The sourcing entity (Purchasing, Engineering or Quality function) shall:
   - — Review the supplier's data from the questionnaire. The supplier must have, as a minimum:
     - A favorable financial performance history indicating long-term financial and operating ability.
     - Capabilities in material, product, and process technology consistent with the technology of the product being supplied.
     - Capabilities in the manufacturing areas consistent with anticipated needs.
     - An organizational structure and interrelationship between functions focusing on supplying quality and reliability consistent with Digital's requirements.
   - — Assess and determine the supplier's suitability and either:
     - Proceed to the next step.
     - End the process.
3. The sourcing entity (Purchasing function) shall arrange a meeting at the supplier's site and shall:
   - — Review the results of the questionnaire.
   - — Distribute copies of this standard, *DEC STD 176-0 Printed-wiring Board Acceptance Criteria*, and all other documentation that details Digital procedures and applicable standards including but not limited to:
     - Product safety regulatory agency comparisons with the product being sourced.
     - Soldermask QVL
     - Inspection checklist
   - — Tour the supplier's facility.
   - — Assess and determine the supplier's suitability and either:
     - Proceed to the next step.
     - End the process and communicate the results to the Supplier.
4. The sourcing entity (Quality function) shall identify or create the qualification team consisting of representatives from Purchasing, Engineering, Quality, Design Engineering, and Assembly.
5. The Qualification Team shall:
   - — Notify the Area Qualification Office of impending qualification activities. Refer to Appendix A for a sample form.
   - — Prepare a qualification plan that allows for sufficient time to fulfill the requirements of this standard prior to first revenue ship (FRS) and submit it to the Area Qualification Office for approval. In the event that a qualifcation is not complete prior to FRS, a waiver from the ICOE Quality Manager is required. Refer to subhead 6.1 for the minimal requirements of a qualification plan and Appendix B for a sample plan.
   - — Approve the audit team. The audit team shall be made up of certified auditors.

6. The audit team shall:
   — Complete the audit requirements. Refer to EL-MF88-01 for audit procedures and checklist.
      • Analyze the supplier's existing systems for controlling materials, processes, products, and production, in order to assess the supplier's capability to meet 100% acceptable quality and delivery performance.
      • Identify the problems and assist the supplier in resolving the corrective actions necessary so that the supplier can maximize quality and delivery performance. Facilitate the enhancement of systems necessary for the implementation of quality programs.
7. The Qualification Team shall:
   — Review and approve the final audit results.

**NOTE**

**The audit is not considered complete until all identified corrective actions are resolved, or a plan is mutually agreed upon for closure.**

8. The Qualification Team shall determine if any of the following qualification activities are necessary by comparing part technology attributes to the supplier's qualified status. Supplier qualification levels for other attributes not contained within the functional class descriptor (FCD) code will be maintained by the Area Qualification Office, for example, surface finish, electrical requirements, hole size, laminate type, lay-up, inner and outer line, width, and space.
   a. Process Qualification (refer to subhead 3.2.1 for procedure).
   b. Product Qualification (refer to subhead 3.3.1 for procedure).
   c. FAI (refer to subhead 3.4 for procedure).
9. The Qualification Team shall:
   1. Review all process and/or product qualification lot test data and assembly evaluation reports.
   2. Reach a final consensus and make a disposition (pass or fail).
   3. Submit a final written report to the appropriate Area Qualification Office with a recommendation for placement or nonplacement on the QVL. The report must include attributes and part numbers used for the qualification. Refer to Appendix C for a sample of a recommended Final Qualification Report.
10. The external supplier shall:
   — In order to perform the final user audit of the product identify at least one person to be trained by the Sourcing Entity (Quality function) about the information in DEC STD 176-0.
11. The external supplier selected for volume production shall begin the volume ramp.
12. The sourcing entity shall:
   — Determine the volume ramp-up schedule.

— Develop a formal plan for ramping up a QVL supplier to the necessary volume requirements. This plan shall include, but not be limited to, the following.

  • PWB technologies that do not exceed the supplier's previously determined material, process, or product qualifications.

  • Volume lot sizes and lot quantities that do not exceed the supplier's process, product quality, or production delivery capabilites, as determined by ongoing assessment of the supplier's performance during ramp-up.

— Assess the supplier's performance by monitoring and inspecting, during ramp-up and subsequent volume, the supplier's quality and delivery performance for lot history requirements as defined in the qualification plan. Feedback from Stage 1 assembly plants should also be included as part of the supplier's assessment.

13. The supplier shall:

— Supply quality product meeting 100% acceptance yields at all incoming inspections with no Stage 1 assembly problems.

— Deliver 100% of the product on schedule.

**NOTE**

**Failure of the supplier to meet the above requirements may warrant the following activites from the sourcing entity.**

- Cease volume ramp-up.
- Initiate the disqualification procedure.

**Figure 3: Process Qualification Flow Diagram**

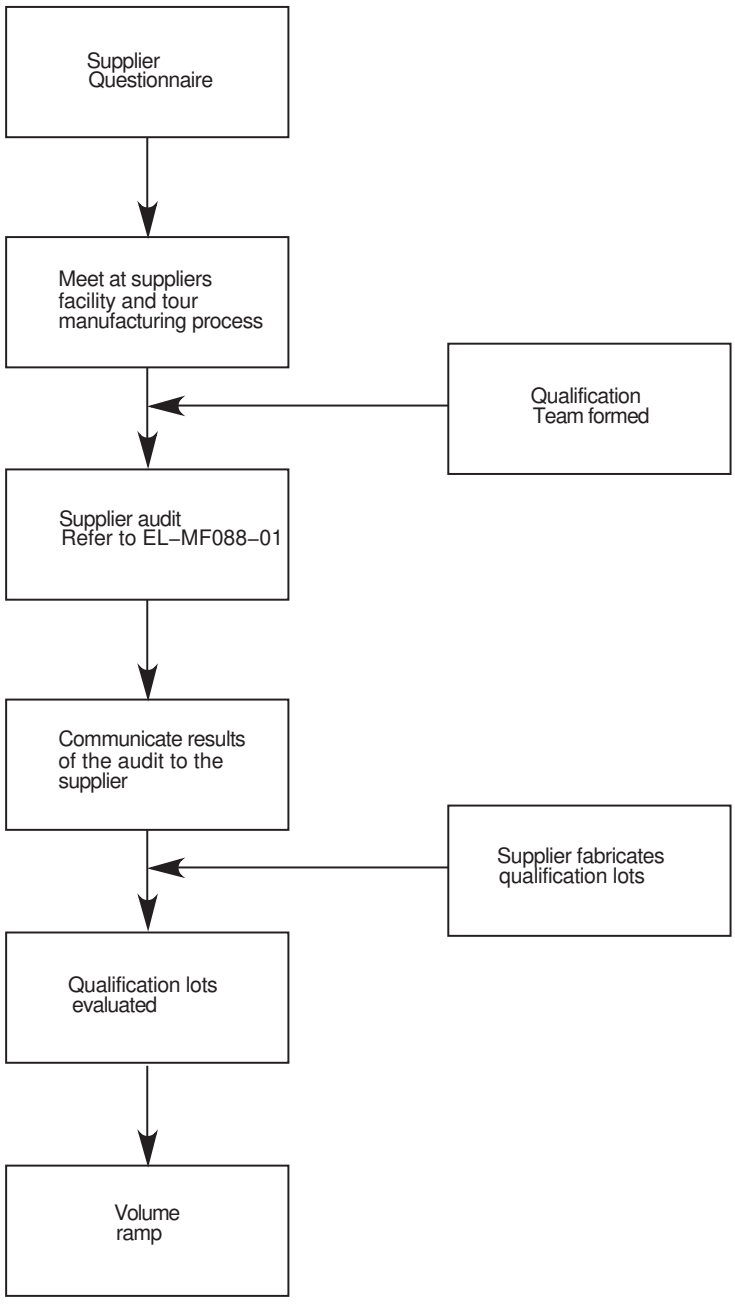
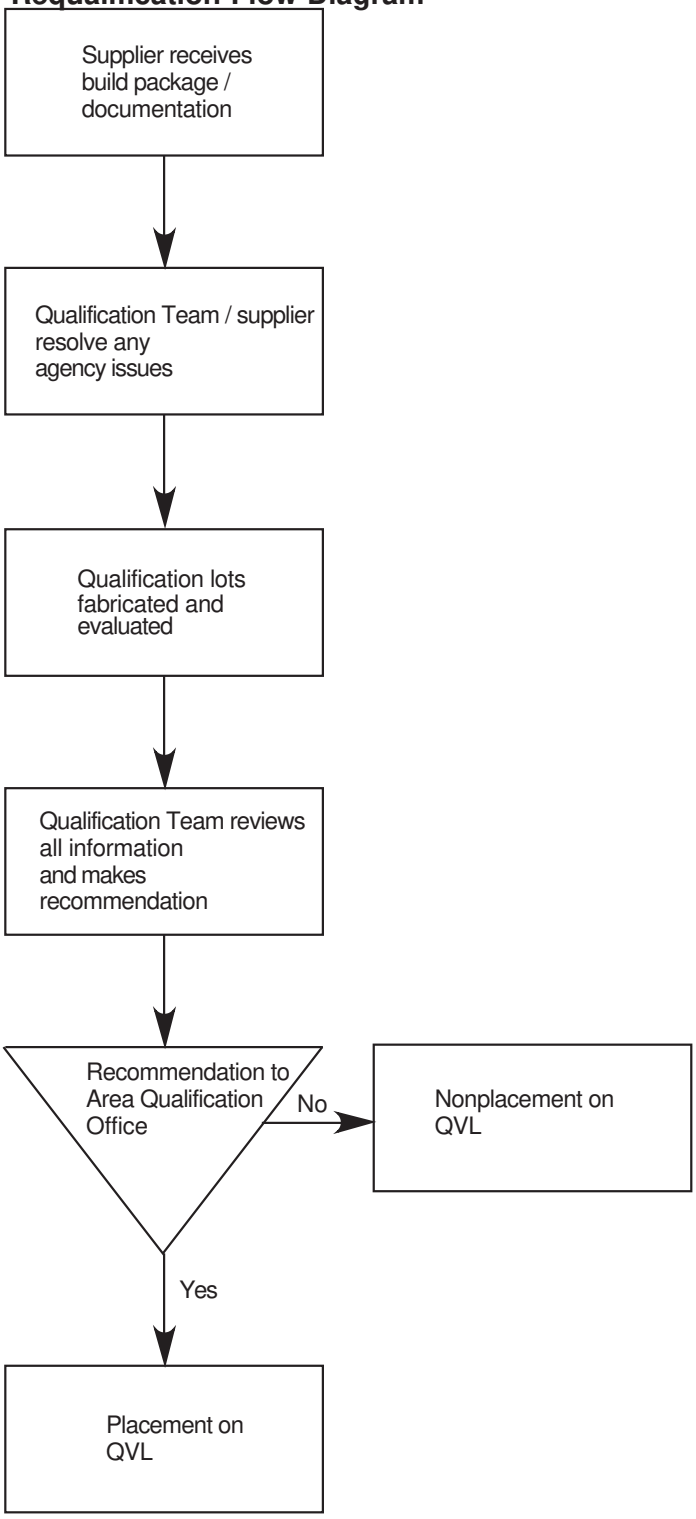

Supplier Questionnaire
Meet at suppliers facility and tour manufacturing process
Qualification Team formed
Supplier audit Refer to EL–MF088–01
Communicate results of the audit to the supplier
Supplier fabricates qualification lots
Qualification lots evaluated
Volume ramp

**Figure 4: Process Requalification Flow Diagram**


Supplier receives build package / documentation
Qualification Team / supplier resolve any agency issues
Qualification lots fabricated and evaluated
Qualification Team reviews all information and makes recommendation
Recommendation to Area Qualification Office
No
Nonplacement on QVL
Yes
Placement on QVL

## 3.2 PROCESS QUALIFICATION OR REQUALIFICATION (REFER TO SUBHEAD 2.2)

The following requirements shall be used to qualify the PWB fabrication processes of a new supplier to Digital. For an existing supplier, as identified in the qualification plan, the procedure applies to processes that have not been previously qualified, as well as qualified processes that have been modified. Refer to Figure 3 for an example of process qualification and Figure 4 for an example of requalification.

The supplier shall communicate in writing all process changes to the sourcing entity (quality engineering function) prior to implementing changes.

The sourcing entity (quality engineering function) along with Stage 1 assembly representatives shall determine if requalification is necessary using the following guidelines.

- Additions or changes have been made to the process affecting the product safety regulatory agency's recognition of the product.
- Additions or changes have been made to the previously qualified process such as:
  - — New raw material
  - — Changes that may affect the quality characteristics and reliability performance of the finished PWB.

If requalification is determined to be necessary, refer to subhead 3.2.1 and follow the procedures.

### Process Qualification/Requalification Procedures

For process qualification, complete the following procedures beginning at step 1. In situations where requalification is required, the sourcing entity (quality engineering function) will assume the responsibility of the Qualification Team and complete the following procedure.

1. The Qualification Team shall:
   - Contact the area qualification office for direction on process-related, regulatory agency issues such as Underwriters Laboratory (UL). Refer to *DEC STD 176-2 Printed-Wiring Board Product Safety Criteria* for guidance.
   - Select product for lots with released part numbers (preferred).
   - Determine product attributes to be tested, sample plan, destructive or nondestructive tests to be performed, test or inspection methodology and acceptance criteria to be applied. Refer to DEC STD 176-0 and/or product specific requirements. Refer to Table 2 for required criteria.
   - Establish quantities of lots (minimum 3) and number of boards for each lot (minimum 10) for achieving criteria.
   - — Lots shall not be sublots of the same production run.
   - Establish qualification acceptance requirements are for lot quantity (minimum 3).
   - — If a previously accepted attribute fails, the ability of the supplier to provide the product, free from defect, shall be proven by meeting corrective action identified by the Qualification Team.

- Determine supplier documentation to be furnished with evaluation lots such as inspection records, quality assurance lot history card, and process fallout information including start quantities, finish quantities, reason for fallout, and corrective action.
- Communicate all process qualification issues and measurement metrics to the PWB suppliers.
- Initiate the process for ordering lots from the PWB supplier.
- Determine the schedule for production and shipment of the lots. The schedule must represent the supplier's volume manufacturing process flow and take into account the process elements that vary in time, such as multiple shifts.

**Table 3: Sample Quantities for Qualification Lot Testing**

| | Lot Number | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Criteria/Major criteria (nondestructive) | 100% | 100% | 100% |
| Criteria/Major criteria (destructive) | 2 | 2 | 2 |

2. The supplier shall:
   - Establish closure on all regulatory agency related process deviations prior to completion of process qualification. Refer to DEC STD 176-2.
   - Establish closure with the Qualification Team on any outstanding product related issues, such as conflicts with specifications, test requirements, product documentation, schedules, or correlation issues.
   - Supply the Qualification Team with a process flow diagram, all applicable process procedures, and all other related documentation.
   - Build and ship qualification lots to the Digital facility identified by the Qualification Team.
   - Send required documentation with each lot.
   - When directed by the Qualification Team, send destructive or nondestructive test results collected during manufacturing of qualification lots.
   - Notify Digital when a different process is occuring.
3. The Qualification Team shall specify that the following steps be performed.

**NOTE**

**Refer to the Glossary for definition of SAQ and SAQ suppliers.**

For nonsupplier assisted qualification (nonSAQ)

- When lots arrive at Digital, 100% visual mechanical inspection (VMI) on all product must be performed.
- Sample qualification lots for destructive testing by a certified test facility. Refer to EL-MF088-02 and EL-MF088-03 for more information.

- Select product for assembly and test evaluations.
- Choose random product samples from each group with each PWB having an equal probability of being chosen for a specific test.
- Send the remainder of the qualification lot to the following areas.

— Submit for assembly evaluation.

— Hold lots for shipment as product until qualification activities are successfully completed.

— Return failures to suppliers.

- Review data and reports from certified test facility and Stage 1 assembly.

For SAQ Suppliers

- Supplier shall perform 100% VMI on all products.
- Supplier shall perform all destructive testing in their certified test facility. Refer to EL-MF088-02 and EL-MF088-03 for more information.
- Supplier shall ship to the Digital facility the following:
  - — VMI data
  - — Destructive test data
  - — Microsections
  - — Microsection boards
  - — Remaining boards from the lot
- At the Digital facility, product will be selected for assembly and test evaluations.
- Send the remainder of the qualification lot to the following areas.
  - — Submit for assembly evaluation.
  - — Hold lots for shipment as product until qualification activities are successfully completed.
  - — Return failures to supplier.
- Qualification Team will review data and reports from supplier, certified test facility, and Stage 1 assembly.
- Stage 1 assembly shall assemble and test boards using the process identified by the Stage 1 assembly representative from the Qualification Team or sourcing entity.
  - — Prepare a detailed report of results. A minimum of 1 lot needs to be reported on for qualification acceptance.

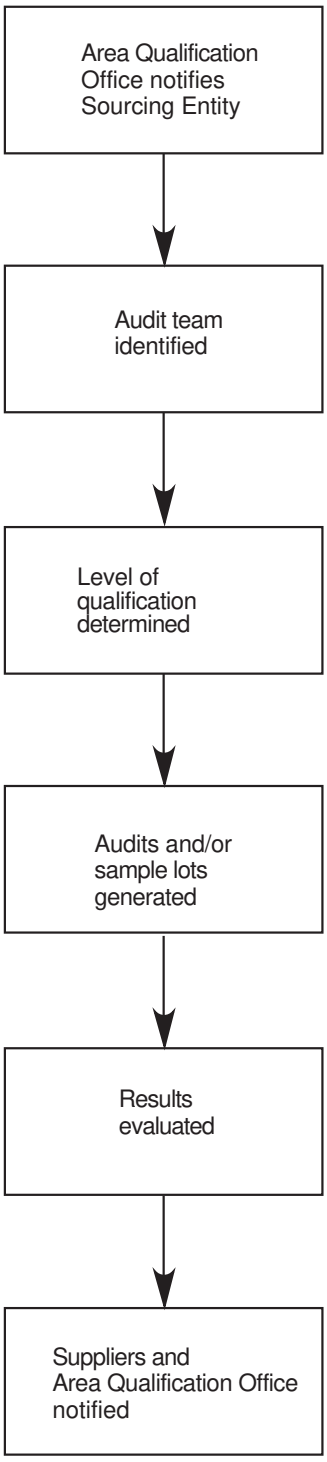
**NOTE**

**Results of the assembly evaluation shall be communicated to the Qualification Team within 3 weeks of sample receipt.**

- Certified test facility shall:
  1. Perform all tests and evaluations as identified by the qualification team.
  2. Present test and evaluation findings to the Qualification Team.
  3. Write detailed report of findings. A minimum of 1 lot needs to be reported on for qualification acceptance.

- Upon completion of the steps, return to subhead 3.1 and continue with number 9B.

**Figure 5: Product Qualification Flow Diagram**


Area Qualification Office notifies Sourcing Entity
Audit team identified
Level of qualification determined
Audits and/or sample lots generated
Results evaluated
Suppliers and Area Qualification Office notified

## 3.3 PRODUCT QUALIFICATION (REFER TO SUBHEAD 2.2)

The following requirements, as identified in the qualification plan, shall be used to qualify product technologies for new and existing suppliers.

**NOTE**

**If the supplier has successfully completed process qualification with a released part number, then those lots may be applied towards product qualification of the same part number.**

### Product Qualification Procedures

For product qualification, complete the following procedures beginning at step 1. In situations where requalification is required, the sourcing entity (quality engineering function) will assume the responsibility of the Qualification Team and complete the following procedure.

1. The Qualification Team shall:
   - Contact the area qualification office for direction on product-related, regulatory agency issues (such as UL). Refer to DEC STD 176-2 for guidance.
   - Select product for lots with a released part number (preferred). If unreleased part numbers are used, the qualification status should be reviewed after release.
   - Determine product attributes to be tested, sampling plan, destructive or nondestructive tests to be performed, test or inspection methodology and acceptance criteria to be applied. Refer to DEC STD 176-0 and/or product specific requirements. Refer to Table 3 for required criteria.
   - For new suppliers, establish quantities of lots (minimum 5) and number of boards for each lot (minimum of 10) for achieving product qualifications.
     — Lots shall not be sublots of the same production run.
   - For existing suppliers, establish quantities of lots (minimum 3) and number of boards for each lot (minimum of 10) for achieving product qualifications.
     — Lots shall not be sublots of the same production run.
   - For new suppliers, establish qualification acceptance requirements for lot quantity (minimum 5).
     — If a previously accepted attribute fails, the ability of the supplier to provide the product, free from defect, shall be proven by meeting corrective action identified by the Qualification Team.
   - For existing suppliers, establish qualification acceptance requirements for lot quantity (minimum 3).
     — If a previously accepted attribute fails, the ability of the supplier to provide the product, free from defect, shall be proven by proven by meeting corrective action identified by the Qualification Team.
   - Notify the qualification office of any waiver to Digital standards or product documentation.
   - Communicate all product qualification issues and measurement metrics to the PWB supplier.
   - Initiate the process for ordering lots from the PWB supplier.

- Determine the schedule for production and shipment of the lots. The schedule must represent the supplier's volume manufacturing process flow and take into account the process elements that vary in time, such as multiple shifts.

**Table 4: Sample Quantities for Qualification for Lot Testing**

| | Lot Number | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Criteria/Major criteria (nondestructive) | 100% | 100% | 100% | 100% | 100% |
| Criteria/Major criteria (destructive) | 2 | 2 | 2 | 2 | 2 |

2. The supplier shall:
   — Establish closure on all regulatory agency related product deviations prior to completion of process qualification. Refer to DEC STD 176-02.
   — Establish closure with the Qualification Team on any outstanding product related issues such as conflicts with specifications, test requirements, product documentation, schedules, or correlation issues.
   — Supply the Qualification Team with process flow diagram, all applicable process procedures, and all other related documentation.
   — Build and ship qualification lots to the Digital facility identified by the Qualification Team.
   — Send required documentation with each lot.
   — When directed by the Qualification Team, send destructive or nondestructive test results collected during manufacturing of qualification lots.
   — Notify Digital when a different process occurs.
3. The Qualification Team shall specify that the following steps be performed.

**NOTE**

**Refer to the Glossary for definition of SAQ and SAQ Suppliers.**

For nonsupplier assisted qualification (nonSAQ)

- When lots arrive at Digital, 100% VMI on all product must be performed.
- Sample qualification lots for destructive testing by a certified test facility. Refer to EL-MF088-02 and EL-MF088-03 for more information.
- Select product for assembly and test evaluations.
- Choose random product samples from each group with each PWB having an equal probability of being chosen for a specific test.
- Send the remainder of the qualification lot to the following areas.
  — Submit for assembly evaluation.
  — Hold lot for shipment as product until qualification activities are successfully completed.

— Return failures to suppliers.

- Review data and reports from certified test facility and Stage 1 assembly.

For SAQ Suppliers

- Supplier shall perform 100% VMI on all products.
- Supplier shall perform all destructive testing on their certified test facility. Refer to EL-MF088-02 and EL-MF088-03 for more information.
- Supplier shall ship to the Digital facility the following:
  - — VMI data
  - — Destructive test data
  - — Microsections
  - — Microsection boards
  - — Remaining boards from the lot
- At the Digital facility, product will be selected for assembly evaluations.
- Send the remainder of the qualification lot to the following areas:
  - — Submit for assembly evaluation.
  - — Hold lot for shipment as product until qualification activities are successfully completed.
  - — Return failures to supplier.
- Qualification Team will review data and reports from supplier, certified test facility, and Stage 1 assembly.
- Stage 1 assembly shall assemble and test boards using the process identified by Stage 1 assembly representative from the Qualification Team or sourcing entity.
  - — Prepare a detailed report of results. A minimum of 1 lot needs to be reported on for qualification acceptance.

**NOTE**

**Results of the assembly evaluation shall be communicated to the Qualification Team within 3 weeks of sample receipt. This report shall be included as part of the final qualification report.**

- Certified test facility shall:
  1. Perform all test and evaluations as identified by the qualification team.
  2. Present test and evaluation findings to the Qualification Team.
  3. Write detailed report of findings.
- Upon completion of the steps, return to subhead 3.1 and continue with number 9B.

### 3.4 FIRST ARTICLE INSPECTION (FAI)

First article inspection is required when a new part number and/or revision is sourced to a supplier that is qualified to build all the technical attributes (including lay-up) and combinations of those attributes, but who has never built the specific part number or revision.

The following requirements, as identified by the sourcing entity (quality) or the Qualification Team, shall be used to perform FAI for new and existing suppliers.

The sourcing entity (Quality function) or the Qualification Team shall:

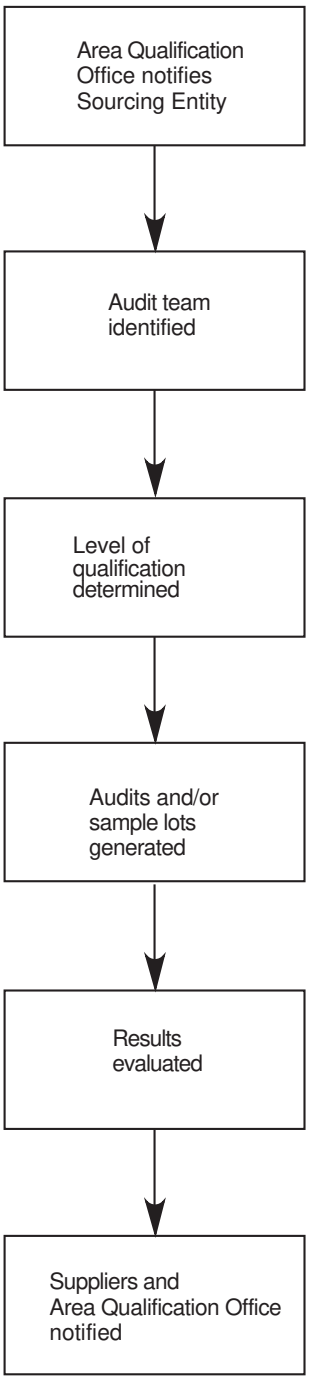
- Specify as a minimum the following requirements.
  - — Quantity—one board minimum.
  - — VMI to applicable specifications (nondestructive).
  - — Greater than or equal to 4-layer PWB requires microsections for lay-up assessment.
  - — Line-width spacing less than 15/15 requires verification of electrical testing.

Microsectioning and evaluation do not need to be performed by a certified laboratory.

Microsectioning must be performed in accordance with EL-MF088-02.

With sourcing entity (supplier and engineering function) approval, a supplier may perform all of the mentioned evaluations and submit a report to the sourcing entity with a physical microsection (4 layers and higher), to meet these requirements. Refer to EL-MF-088-02 for suggested destructive test and microsection procedures. Digital reserves the right to perform additional tests to validate DEC STD 176-0 and applicable engineering specification compliance.

**Figure 6: Qualification Retention Flow Diagram**


Area Qualification Office notifies Sourcing Entity
Audit team identified
Level of qualification determined
Audits and/or sample lots generated
Results evaluated
Suppliers and Area Qualification Office notified

# 4 RETENTION OF QUALIFICATION

The following requirements shall be used to assess qualified suppliers presently on the QVL. Meeting the requirements of this assessment allows for retention of the supplier on the QVL. The qualification office shall ensure reliability testing of the highest technology level as part of the annual supplier retention. The procedure shall be performed at least once within a 12 month period for all suppliers. Refer to subhead 3.3.1 for product qualification procedures.

If a supplier retention audit is overdue more than 30 days, the area qualification office will communicate the delinquency to the sourcing entity.

- The sourcing entity will be given 30 days to schedule the retention audit.
- The area qualification office will send a second reminder to the sourcing entity if 60 days has gone by and a retention audit has not been performed.
- If the supplier reaches 90 days overdue, then the area qualification office shall instruct the component engineer to remove the supplier from the QVL.

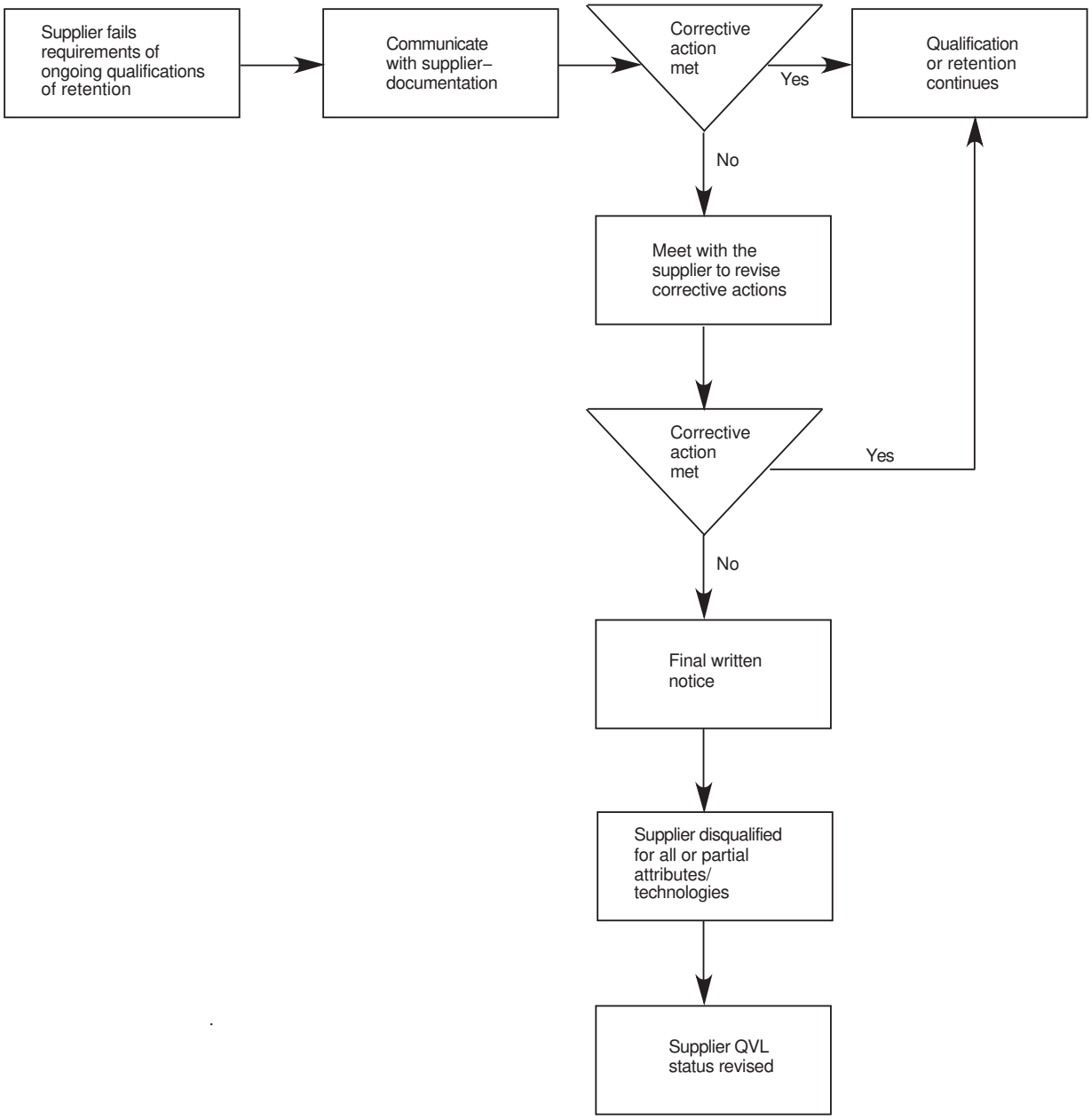
## RETENTION PROCEDURE

To complete the following procedures, begin at step 1.

1. The area qualification office shall supply the following information to the appropriate sourcing entity.
   - Name of the supplier
   - Month the audit should be performed
   - Location
2. The sourcing entity shall:
   - Choose the audit team. The audit team shall be made up of certified auditors.
   - Review the previous audit summary.
   - Examine supplier volume and lot history to meet the sourcing entity's volume requirements. This may result in the supplier being reviewed for disqualification and/or being removed from the QVL with approval of the Area Qualification Office.
   - Examine Stage 1 assembly process for PWB related failure data.
   - Determine the location where samples for evaluation (minimum 1) will be obtained for qualification testing, for example, Stage 1 assembly or the sourcing entity's incoming inspection. Samples will be tested for ongoing compliance to the appropriate levels of product quality, functionality, reliability, and for those attributes representative of a given technolgy.
   - Prior to the audit ensure the supplier has the latest revision of EL-MF088-01.
   - Perform the audit according to EL-MF088-01. The audit may be either partial or complete depending of the supplier's history and the judgement of the quality manager. Additional audit items not present in the original supplier audit (revision as compared to prior audits) must be communicated to all suppliers.
   - Select or request samples from a designated location.
   - Submit the samples to an certified test facility.

- Make the final desision after evaluation of the audit and sample testing as to whether a supplier should retain QVL status.
- Submit all audits and qualification test results to the area qualification office with a recommendation to either retain QVL status or begin disqualification procedures. Refer to head 5 for disqualification procedures.

## Figure 7: Supplier Disqualification Flowchart



## 5 SUPPLIER DISQUALIFICATION

The following requirements shall be used for all QVL suppliers. This procedure allows a consistent and equitably applied process for disqualifying suppliers and removing them from the QVL.

1. The sourcing entity shall recommend to the area qualification office the immediate removal of a supplier from the QVL when the following occurs.
   - The supplier is no longer in business.
   - The supplier fails to meet volume lot history.
   - No activity has occurred, on any part number containing the supplier's highest qualified technology level, within a 12 month period.
2. The sourcing entity shall recommend to the area qualification office a revised QVL status when to product representative of the highest technology level for which the supplier is qualified, has been either:
   - Delivered or accepted
   - Undergone qualification
   - Undergone retention
3. When a change occurs in ownership of a QVL supplier, the sourcing entity shall review and determine, which of the following activities are appropriate and recommend one of the following to the area qualification office.
   - Immediate removal from the QVL
   - Change not be made to the QVL status
   - Requalify the supplier according to subhead 2.1
4. The sourcing entity shall follow the disqualification procedure when:
   - The supplier fails to meet the established quality and delivery levels and resulting corrective actions.
   - The supplier fails the audits or retention requirements. Refer to subhead 5.1 for these requirements.
5. The area qualification office shall:
   - Notify the ICOE component engineer to remove the supplier from the QVL, when required.
   - Instruct the component engineer to remove the supplier from the QVL if 15 months have elapsed without a retention audit.

### DISQUALIFICATION PROCEDURE

Complete the following items for the disqualification procedure, beginning at step 1. The Qualification Team shall make all decisions during this procedure. If the Qualification Team is not in existence, the sourcing entity, in conjunction with the area qualification office, shall make all decisions.

1. The sourcing entity shall:
   — Set up a meeting at the supplier's site.

— Document and distribute a letter to all attendees inclusive of the following information.

- Agenda items
- Problems reviewed
- Audit results (if applicable)
- Supplier's corrective actions
- Dates established for implementation and completion of all corrective actions

— Consider tightened inspection of supplier's product.

2. The sourcing entity shall review and determine if either:

— The supplier's quality and delivery performance meet the established requirements after implementation of the corrective actions. As a result, the QVL status shall remain the same and disqualification procedures shall end.

— If the supplier fails to meet quality and delivery requirements after the corrective actions implementation, a written warning shall be sent stating: No affected part numbers shall be acquired from the supplier until successful completion of requalification has occurred. Refer to subhead 3.2 for requalification requirements.

3. The sourcing entity (Purchasing function) shall submit a disqualification notification to the area qualification office including QVL impact, and the period of time before requalification may occur.

4. The area qualification office shall:

— Notify the ICOE component engineer to remove the supplier from the QVL, when required.

**NOTE**

**The period that must elapse before requalification can resume, shall be, at the discretion of the area qualification office, based on cause for disqualification and the effects of disqualification on Digital.**

## 6 DOCUMENTATION CONTROL AND ADMINISTRATION

The requirements under this heading apply to all documents used in the decision-making processes specified in this document.

### 6.1 QUALIFICATION PLAN REQUIREMENTS

The qualification plan shall include, but not be limited to, the following information. Refer to Appendix B for a sample plan.

1. Stage 1 evaluation site
2. Members of the Qualification Team
3. Extent of the qualification, for example, product, process, and first article test
4. Part number(s) and attributes
5. Supplier(s)
6. Schedule of events

7. Required test criteria
8. Lot quantity and size
9. Sample size
10. Test laboratory
11. All applicable specifications and standards, with revision in effect

### 6.2 QVL REQUIREMENTS

At the beginning of the qualification activity and at completion, the QVL shall be updated to reflect appropriate part number and supplier status. Refer to Appendix C for a sample form.

### 6.3 OTHER REQUIREMENTS

The following documents will be used as a result of implementing the processes required by this document:

- Questionnaire—Refer to EL-MF088-00
- Supplier Audit—Refer to EL-MF088-01
- Destructive testing and microsectioning guidelines—Refer to EL-MF088-02
- Laboratory certification and audit procedures—Refer to EL-MF088-03
- Final qualification report drafted by sourcing entity (Quality engineering function) reviewed and signed by the Qualification Team
- QVL
- QVL retention audits and qualification test reports

For each supplier, the listed documents shall be placed on file with the Area Qualification Office for administration.

For random qualification retention audits and product qualification tests, a calendar file will be established and maintained by the Area Qualification Office. Sourcing entities will be provided with annual schedules for audits and reliability testing that will be updated quarterly.

Sourcing entities shall be notified by the Area Qualification Office a minimum of 30 days prior to the date of qualification retention audits or product testing indicated in the calendar file.

Results of all audits, changes in qualification documentation, and any changes reflected in the applicable supplier of part number lists, shall be communicated to the area qualification office within 1 week of the changes. In addition, in the case of changes affecting the supplier's QVL status, this information must immediately be communicated to the ICOE quality management.

# APPENDIX A NOTIFICATION OF IMPENDING PWB SUPPLIER QUALIFICATION

Product Family / SYSTEM

| | |
|---|---|
| Examples | VAX 6000 Series<br>VAX 9000 Series |

Part Numbers to be Used to Evaluate Suppliers, If Known

| | |
|---|---|
| Examples | 50-17235-01<br>50-17457-01<br>50-20230-01 |

Suppliers Being Considered

| | |
|---|---|
| Examples | GSO<br>Fujitsu<br>Diceon |

Qualification Team Members

| | |
|---|---|
| Example | PWB Quality Representative<br>Design Engineering Representative<br>Sourcing Entity Representative<br>Stage 1 Assembly Representative<br>other members |

Preliminary Schedule of Events

| | | |
|---|---|---|
| Example | Select suppliers | 1/10/90 |
| | Select part numbers | 1/30/90 |
| | Generate quality plan | 2/15/90 |
| | Audit suppliers | 3/15/90 |
| | Build evaluation lots | 5/10/90 |

# APPENDIX B SAMPLE QUALIFICATION PLAN

- Title page and revision level
- Approval signatures (high level)
- Revision history

## Table of Contents


Overview
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- Suppliers
- Qualification team
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First article inspection

Critical criteria
- Nondestructive criteria
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  - Audit addenda questions
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  - Qualification costs
  - Requalification costs
  - Supplier qualification lot Data collection form

# APPENDIX C FINAL QUALIFICATION AND NONQUALIFICATION REPORT

## C.1 PURPOSE

The purpose of this procedure is to define the process for making modifications to the Corporate Qualified Vendors List (QVL). The QVL is a Corporate data base which lists suppliers by part number and qualification status.

## C.2 RESPONSIBILITIES

Requester - Complete attached QVL Request Form and submit to Area Qualification Office.

**NOTE**

**If the supplier is not qualified for all attributes, a qualification plan must be sent to the Area Qualification Office for approval.**

Area Qualification Office (AQO) - AQO reviews request for accuracy, completeness and conformance to *DEC-STD-088-0 Qualification Procedure for All Printed-Wiring Board Suppliers*.

Corporate Component Engineer (CCE) - Upon receipt of approved QVL Request Form from AQO, the CCE will update the QVL.

## QVL REQUEST FORM

* All requests should be submitted to the Area Qualification Office which covers the geographical area where the supplier is located.
* The Corporate Component Engineer should also be copied. The CCE will monitor requests and ensure requests are being processed accurately and timely.
* The requester must indicate what type of qualification is required (FAI, product, and process).
* The requester must indicate what QVL code is required (E=evaluation, Q=qualified, and R=risky).
* Each part number / supplier combination must be submitted on a separate form.
* Each request must contain the following:

QVL ADD / UPDATE REQUEST

Requester:

Part Number:

Revision (if known):

Supplier:

Supplier Site:

FCD:

Unique attributes (attributes not covered by FCD or Part Description for example: new soldermask, special true position diameter (TPD) requirements):

Qualification Requirements:

FAI

Process Qualification (attach Qual Plan)

Product Qualification (attach Qual Plan)

QVL Status Code:

E

Q

R

Comments:

# APPENDIX D QUALIFICATION OF ATTRIBUTES BY STATISTICAL DATA

## D.1 SCOPE

At their discretion, the qualification team may incorporate into the qualification plan the qualification of attributes by statistical data either in part or as a whole, to affect process or product qualification under this standard. This alternative should follow the criteria set out in this appendix.

## D.2 STATISTICAL ADVISOR

When using Appendix D, Qualification Of Attributes By Statistical Data, as an alternative, the qualification team shall have access to a statistical advisor. The statistical advisor shall be approved by the PWB ICOE quality manager, who need not be a member of the team, but shall provide opinion on the validity of the analysis in areas outside the expertise of the team.

## D.3 SELECTION OF VARIABLES AND ATTRIBUTES

Statistical data used for qualification shall relate directly to attributes contained in DEC STD 176 or to additional attributes specified by the program or the qualification team.

The program shall provide goals in terms of parts per million (PPM) defects or process capability index (Cpks) for each of the attributes listed in DEC STD 176 or added by the program. The qualification team shall provide goals on the attributes added by them. The minimum goal shall be Cpk equal to 1.33 or an equivalent PPM figure.

## D.4 SUPPLIER/TEST ENVIRONMENT CONDITIONS

The following procedures shall be performed to assess the environmental conditions of the supplier.

1. Audit of Statistical Process Control (SPC)/Measurement Systems according to IPC-PC-90 *General Requirements for Implementation of Statistical Process Control*.
2. The systems used by the supplier (that provide data to the qualification team) shall be audited according to DEC STD 088-0 and IPC-PC-90 for their ability to provide accurate information.
3. Error studies shall be conducted that estimate the expected difference between the measuring systems of the supplier's laboratory and the Digital qualification laboratory. Additional studies may be required to identify and reduce variation between the laboratories.

## D.5 DATA

- The supplier data shall be used whenever possible. The use of supplier data will be based on an audit of the supplier's SPC program.
- The number of data points used to determine PPM/Cpk may vary. The volume of data to be drawn from the supplier will be approved by the qualification team with input from the statistical advisor.

## D.6 Analysis

The following guidelines should be used when determining PPM/Cpk.

1. Distribution (normal)
   - — Direct calculation of standard deviation
   - — Control chart (associated average method)
2. Distribution (exception)
   - Control chart
   - Log normal probability chart
   - Direct calculation from use of appropriate distribution

Deviations from documented techniques listed in the references will be considered if accompanied by an explanation of appropriateness.

The supplier may isolate points from the data stream when calculating Cpk if such data can be shown to be dependent upon a special cause for which successful corrective action has been taken to prevent recurrence.

## D.7 QUALIFICATION TEAM DELIVERABLES

The qualification team shall deliver in table format, to the executive committee, the following:

1. Cpk and/or PPM estimate for each attribute listed in the attribute list including the number of data points used in the method of estimating PPM/Cpk and the stated goal.
2. Recommendations to the Digital customer on quality activities to monitor the supplier in an ongoing fashion.
3. If qualification of attributes has been by statistical data, the qualification plan should retain the details of the frequency of examination of the supplier's process data.

# APPENDIX E GUIDELINES

QUALIFICATION GUIDELINES

| PROCESS QUALIFICATION | PRODUCT QUALIFICATION | FIRST ARTICLE INSPECTION |
|---|---|---|
| 1. New Supplier<br><br>2. Major change to previous qualified Process.<br><br>3. Product requires a unique process or new material.<br><br>NOTE:<br>Test vehicles may be used if the Qualification Team determines that the attributes in the test vehicle are representative of the product to be qualified. | 1. Not required if product meets low technology exemptions. Refer to subhead 2.2.3 for more information.<br>– Layers (less than 5)<br>– Minimum Line width/space (greater than or equal to 0.012/0.013 in. [.3048/.3302 mm])<br>– Aspect Ratio (A/R) less than or equal to 3:1<br>– Material FR4, CEM3<br>– Product does not contain other high technology attributes such as but not limited to controlled impedance, planar resistor, and exotic materials.<br><br>2. Is required for a given supplier when the Qualification Team determines that one of the following factors exists.<br>– The part incorporates new tech–nology attributes (including layup) exceeding those listed in subhead 2.2.3 and the supplier is not qualified for that level of technology. Refer to Appendix F.<br>– The part number contains unique or interacting combinations of attributes (such as the combin–ation of 12.5 mil pitch SMT and Solder mask Over Bare Copper (SMOBC)). Refer to subhead 3.3 for more information.<br>NOTE:<br>Process Qualification Lot History/ Quantities may be applied to Product Qualification Requirements when approved by the Qualification Team. | 1. Not required when a supplier has completed process and/or product qualification for a specific part number and associated revision.<br><br>2. Is required when a part number or part revision is sourced to a supplier that is qualified to build all the technical attributes (including layup) and combin–ations of those attributes, but has never buiilt the specific part number and/or part revision. Refer to subhead 3.4 for procedures and more information. |

**NOTE:**

This chart is provided as a ready–reference only. Refer to the main document for more detailed information or Supplier Qualification Requirements.

# APPENDIX F ATTRIBUTE TABLE

This table shall be used to determine whether or not product or process qualification is required for a given part number and supplier. It is based on bracketing attributes into ranges wherein the range that only FAI is required. Moving down the page is increasing difficulty, as a new range is entered for the first time, a product or process qualification is required.

Examples:

If a supplier is qualified for a line width of 8 mils and the part number has a line width of 5 mils, then only FAI needs to be performed.

If a supplier is qualified for 4 layers and the part number has 6 layers, then a product qualification needs to be performed.

**FAI VERSUS PRODUCT QUALIFICATION**

| | | |
|---|---|---|
| Layers | 1 | |
| | 2 | Normally requires plated through-hole (PTH) |
| | 3 <–> 4 | Normally mass lamination (process qual) |
| | 5 <–> 8 | Normally requires pin lamination |
| | 9 <–> 12 | Normally nonedge card (0.093 inch thick module card) |
| | 13 <–> 18 | Backplane |
| | | Higher degree of sophistication in lamination process |
| | 19 <–> 24 | Normally higher thermal glass transition temperature (Tg) and aspect ratio and more difficult lamination process (thicker backplane) |
| Nominal thickness (MILs) | <50 | Special fab process set-up (handling and so forth) |
| | 50 <–> 70 | Standard edge card |
| | 71 <–> 125 | Normally requires special handling and so forth in fab process |
| | 126 <–> 187 | Normally backplane with additional requirements |
| | >187 | Nonstandard |

| | | |
|---|---|---|
| Aspect ratio | </=4:1 | Normally standard technology and readily available |
| | >4:1 <–> 7:1 | Higher degree of difficulty (plating) |
| | >7:1 <–> 10:1 | Higher degree of difficulty (small hole) |
| | >10:1 | Higher degree of difficulty (all processes) |
| Nominal line width (MILs) | >15 | Standard technology, readily available |
| | 15 <–> 9 | Higher degree of control required at imaging, etching, and plating |
| | 8 <–> 5 | Normally 2 track technology requiring different image transfer process, for example, silk screen to photo resist and tighter etch controls |
| | 4 | Normally 3 track with higher degree of difficulty at all processes |
| | 3 | Each reduction reguires more than FAI |
| Nominal space width (MILs) | >/=11 | Standard technology, readily available |
| | 10 <–> 6 | Normally 2 track technolgy requiring different image transfer process, for example, silk screen to photo resist and tighter etch controls |
| | 5 <–> 4 | Normally 3 track with higher degree of difficulty at all processes |
| Annular ring (Hole-to-pad) | FHS + pad size >/=0.020 | Standard technology readily available |
| | FHS + pad size </=0.020 - 0.015 | More difficult registration requirement |
| | FHS + pad size < 0.015 | Increase risk of adverse registration requirement |

| | | |
|---|---|---|
| Surface Mount Technology (inch) | 0.100-0.026 | Requires different fab consideration related to soldermask, surface finish, test, and so forth |
| | .025 <–> .019 | Higher degree of difficulty effecting tolerances for true position diameter (TPD), pad features, fiducial to pad, solder thickness control |
| | .018 <–> .010 | Into high performance tape package (HPTP) range, requirements |
| Minimum Hole size (inch) | >.042 | Normally standard technology and readily available |
| | .042 <–> .032 | Higher degree of difficulty affecting TPD, drilling and plating |
| | .031 <–> .015 | Higher degree of difficulty affecting TPD, drilling and plating |
| | .014 <–> .010 | Micro hole drilling, leading-edge technology |
| | <.010 | Micro hole drilling, leading-edge technology |

## FAI VERSUS PROCESS QUALIFICATION

| | |
|---|---|
| Surface finish | Each type of surface finish requires more than FAI |
| Laminate | Each ANSI grade (FR4,BT, and polyimide and so forth) of laminate requires more than FAI |
| Electrical | Each electrical requirement (CI, CC, and so forth) requires more than FAI |
| Soldermask | Each type of soldermask requires more than FAI<br>Also refer to *EL-MF543-00 Procedure for Soldermask Evaluation.* |

# APPENDIX G REFERENCED DOCUMENTS

## G.1 Digital Documents, EL-Class

| Document Number | Document Title |
|---|---|
| EL-00176-00 | *DEC STD 176-0 Printed-Wiring Board Acceptance Criteria* |
| EL-00176-01 | *DEC STD 176-1 Printed-Wiring Board Repair Criteria* |
| EL-00176-02 | *DEC STD 176-2 Printed-Wiring Board Product Safety Criteria* |
| EL-00176-03 | *DEC STD 176-3 Printed-Wiring Board Acceptance Criteria for SMOBC (Soldermask Over Bare Copper) Product* |
| EL-00176-04 | *DEC STD 176-4 Surface Mount Printed-Wiring Board Acceptance Criteria* |
| EL-MF088-00 | *Printed-Wiring Board (PWB) Supplier Questionnaire* |
| EL-MF088-01 | *Printed-Wiring Board Supplier Audit Checklist* |
| EL-MF088-02 | *Destructive Testing Procedures and Microsectioning Guidelines for Printed-Wiring Boards (PWBs)* |
| EL-MF088-03 | *Laboratory Certification and Audit Procedures for Facilities that Inspect/Test Printed-Wiring Boards (PWBs)* |
| EL-MF543-00 | *Procedure for Soldermask Evaluation* |

Use VTX SMC to order copies of EL-class documents from Standard and Methods Control. Send distribution questions to JOKUR::SMC or call DTN: 234-4423.

## G.2 Documents External to Digital

| Document Number | Document Title |
|---|---|
| IPC-PC-90 | *General Requirements for Implementation of Statisical Process Control* |

Copies of the IPC publication may be purchased from:

The Institution for Interconnecting and Packaging Electronic Circuits
7380 N. Lincoln Ave
Lincolnwood, IL 60646
Telephone (708) 677-2850

# GLOSSARY

**Area Qualification Office**: A functional office within the U.S., GIA, and European PWB community responsible for the administration of this document, as well as maintaining all documentation and files required for the implementation. The Qualification Office shall serve in a consultant role for application, technical service, and training for those groups responsible for implementing the requirements of this document in their respective geographical areas.

**assembly (Stage 1)**: The organization(s) within Digital involved with assembling PWBs and components into finished module assemblies.

**audit team**: A group comprised of cross-functional members responsible for administering EL-MF088-01 for suppliers involved in the qualification processes.

**Cpk**: Process Capability Index

**critical acceptance characteristics**: A list of product and program-specific material, process, and product technology specifications that must be met or exceeded on all qualification PWBs. These characteristics are defined in DEC STD 176-0 or product-specific engineering documentation that supersedes all other specifications and requirements. For those characteristics not defined in Digital standards, all criteria values, tolerances, measurement methodologies, and procedures shall be defined by the responsible design engineer as a member of the qualification team.

**critical raw material**: Any raw material that affects the function, reliability, and process of the PWB through the module assembly process. This raw material also affects the intended long-term reliability of the module in its field application.

**design engineering**: The organization(s) within Digital with the overall responsibility for the actual Digital program or product containing the PWBs as a component. The design engineer initiates the implementation of the requirements in this document for new products at the earliest stage of the program or product design cycle. The responsible design engineer participates in all qualification recommendations for new and existing suppliers, materials, and processes used in PWBs supplied to Digital.

**existing product**: Products that have been released with a 50-class part number and are in systems that have over 1 year existence in the field. Released products may or may not be volume shipments to the market.

**first article inspection (FAI)**: A sampling inspection for the purpose of verifying conformance to all requirements of the first product built by a PWB supplier from product data, documentation, and tooling supplied by a sourcing entity.

**FCD**: Functional Class Description is a code assigned to 50-class PWB products that relates to a specific level of technology for a particular part number. For detailed information contact PWB Component Engineering.

**new product**: An unreleased product that may or may not have a 50-class part number and is currently being designed for release.

**PPM**: parts per million

**process**: For the purpose of PWB process qualification, a process is defined as a series of discrete operations performed in the fabrication of PWBs.

**process flow diagram**: The process flow diagram shall include the listing of all engineering, fabrication, and in-process final inspection processes used in the fabrication of PWBs in the exact sequence of occurrence.

**process procedure**: A process procedure is a document under revision control that includes descriptions of how all equipment and operations constituting the process are to be performed, monitored, and controlled.

**Purchasing**: The function within the Digital organizations involved with overall procurement needs and material acquisition activities, such as: obtaining quotations, placing orders, order tracking, and other order administration activities. Purchasing is responsible for initiating the implementation of the requirements in this document when the need arises to identify and qualify new suppliers for existing products.

**qualification team**: A cross-functional team representing the Digital functions responsible for direct interface with the supplier, participating as partners in the process leading to recommendations for qualifying or disqualifying a supplier. (For example, a team might consist of Design Engineering, PWB Quality, PWB New Product Engineering, Stage 1 Assembly Engineering, PWB Program Management, Producibility, and Volume Manufacturing.)

The make-up of this team is determined by the type of qualification desired: supplier, material, process, or product as defined throughout this document. The make-up of this team is primarily influenced by the type of product technology: new or existing.

For qualifying new and existing suppliers, materials, and processes for new products, the make-up of the team shall consist of the individuals from the product functions within the organizations. The specific manufacturing organizations shall be identified by the responsible design engineer.

For qualifying or disqualifying new and existing suppliers, materials, and processes for existing products, the make-up of the team shall consist of the individuals from the volume production functions within the organizations previously defined. The manufacturing organizations shall be identified by the sourcing entity requiring the qualification or disqualification. (The responsible design engineer, designee, or current engineering representative for the product should also participate as a team member.)

The area qualification office can be consulted for recommendation on the membership of the qualification team.

**Qualified Vendor List (QVL)**: A listing of all suppliers by part number qualified under all sections of this document to ship product, to Digital Stage 1 Assembly plants. Listing on the QVL denotes that a supplier has met all the requirements in this document.

**Quality Engineering**: The function within Digital organizations involved with purchasing support and carrying out the Quality or Engineering function requirements of this document.

**SAQ**: Supplier Assisted Qualification

**SAQ Supplier**: Supplier who has met all the requirements to do SAQ. Supplier must have approval of sourcing entity supplier engineering function and have their laboratory certified according to EL-MF088-03. SAQ suppliers can perform process, product, and FAI qualification.

**sourcing entity**: The organization(s) within Digital responsible for all activities involved with supplying PWBs from external suppliers to Digital. The sourcing entity includes the following functional organizations: Purchasing, Quality, Engineering, and Materials. For internal suppliers, the PWB Group Quality is the sourcing entity.

**supplier**: Any supplier, internal or external to Digital, engaged to fabricate PWBs for Digital.

**volume lot history**: The record of a supplier's quality and delivery performance against commitments to the sourcing entity, over a given time.

**visual mechanical inspection (VMI)**: Visual Mechanical Inspection (nondestructive testing) is performed to ensure critical acceptance criteria as contained in DEC STD 176.

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